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RESEARCH PAPER

Evaluation of physico- biochemical traits in kodo millet (*Paspalum scrobiculatum* L.)

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The present study was conducted to evaluate ten advanced germplasm of kodo millet for different physico- biochemical and yield related traits in kodo millet (*Paspalum scrobiculatum* L.) during *Kharif* 2013- 14 at the Students' Instructional farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) India. A wide range of variability were observed for all the characters studied in 10 kodo millet germplasm collected from farmer's field of eastern U.P. A significant variation was detected for all traits suggested that there was considerable variability among the germplasm. It was observed that characters *viz.,* plant height of different germplasms recorded between . 50.85 to70.07cm. The 1000- seed weight (test weight) of different germplasms was recorded between 3.86 to 7.78 g and maximum protein content was recorded in the germplasm NDK-8 (9.86%). The maximum crude fibre content was obtained in the germplasm NDK-9 (6.90%) followed by NDK2 (6.81%) and NDK7 (6.80%). Maximum total mineral content was noticed in NDK-5 (2.29%) and lowest content was recorded in NDK-4 (1.94%). These parameters are effective for selection of better germplasm. So these were utilized in further research work.

Key words : Germplasm, Crude fibre, Total mineral

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INTRODUCTION

Kodo millet, (*Paspalum scrobiculatum* L.), is an indigenous cereal of India and widely distributed in damp habitats across the tropics and subtropics of the world. It occupies an area of 9.08 lakh ha with an annual production of 3.11 lakh tonnes and average productivity of 342 kg/ha (Ahmad and Yadava, 1996). Kodo millet is propagated from seed, ideally in row planting instead of broadcast sowing. It prefer very fertile, clay based soil (Agricultural service, 2013).The kodo millet is prone to lodging at maturity, causing loss of grain (Wet and Prasada, 1983). Kodo millets constitute a group of small seeded cereal species with cultivation history of more than 3000 years in Indian sub continent. Wider adoptability, easy cultivation, ability to tolerate biotic and abiotic stresses has made this crop as a major component of dry farming ecosystem. The crop is not as important in terms of the agro ecosystem.

In India the cultivation of kodo millet is wide spread. The crop is grown with substantial areas in Madhya Pradesh, Chhattisgarh, Maharashtra, Uttar Pradesh and Tamil Nadu. Despite of declining area during last decade, the production of this millet has been more or less maintained by increasing productivity. Kodo millet can survive well on marginal soils and var. *scrobiculatum* requires very little water in order to grow, as it is drought tolerant. It can be cultivated without irrigation. In India, Kodo millet is ground into flour and used to make pudding. It is also a good choice for animal fodder for cattle, goats, pigs, sheep and poultry (Heuze *et al.,* 2012).

Kodo millet contains 66.6 g of carbohydrates and 353 kcal per 100 g of grain. It also contains 3.6 g of fat per 100 g. It provides minimal amounts of iron (0.5/100 mg) and calcium (27/100 mg). Kodo millet also contain high amounts of polyphenols, an antioxidant compound (Hegde and Chandra, 2005).

The grain itself varies in colour from light red to dark grey and is enclosed in a tough husk that is difficult to remove. It is, however, deficient in amino acid tryptophan. It is also reasonably low in fat. It has been recently shown in studies on diabetic rats that both kodo millet and finger millet which are high in antioxidants have a very beneficial effect in protecting against oxidative stress and maintaining glucose levels in type 2 diabetes.

Kodo millet is nutritionally comparable with other common food material and found superior to rice and wheat in some aspect like minerals and crude fibres. The fibres content of the whole grain of kodo millet is very high. It has around 11 per cent protein and the biological value of the protein has been found to be slightly better than other millet. The grain is used in traditional medicine system to treat diabetes and also good for joint health and wound healing. Minor millet in addition to their nutritional benefit are rich in phytochemicals including phytic acid, which is believed to lower cholesterol level and phytate is associated with cancer risk. Kodo millet widely known for its anti nutritional constituent such as trypsin inhibitors, phytate, phenols and tannin protects oxidative stress by chelating iron involved in Fenton's reaction,while some phenolics and tannin acts as antioxidant. The grain is used in traditional medicine to treat diabetes. In 2010, the global average yield of millet crops was 0.83 tonnes per hectare. The most productive millet farms in the world were in France; with a high average yield of 3.3 tonnes per hectare in 2010 (Production of crops millet, 2010). According to Food and Agriculture Organization (2011), the production of millet were noticed in India was (8,810,000 tonnes), Nigeria (4,884,890 tonnes), Niger (2,677,860 tonnes), Mali (1,390,410 tonnes) and China (1,225,579 tonnes).In India, major millet producing states are Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu and Uttar Pradesh. Gorakhpur, Basti, Gonda, Deoria, Bahraich and Sultanpur districts are major kodo millet producing regions in eastern U.P. The present investigation was carried out during *Kharif* season of 2013.

RESEARCH METHODOLOGY

The details of the materials used and standard methods employed in the present investigation are mentioned below :

Experimental site :

The present investigation was carried out at the Students Instructional farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) India and during the cropping season the minimum temperature was 22.5^{0}C and the maximum temperature was 41^{0}C, the relative humidity ranged between 35- 98 per cent and total rainfall received was 792.3 mm.

Experimental materials :

Ten germplasm of kodo millet namely NDK- 1, NDK-2, NDK-3, NDK-4, NDK-5, NDK-6, NDK- 7, NDK-8, NDK-9 and NDK-10 were collected from different parts of Uttar Pradesh and used as experimental materials.

Experimental details :

The seeds of kodo were sown in Randomized Block Design with three replications on 07 July 2013. The row to row and plant to plant spacing were kept 30cm and 5 cm, respectively. The seeds were sown at the rate of 8 kg/ha, fertilizer NPK was applied at the rate of 30:20:20 kg/ha. Besides this, all other recommended agronomical practices were adopted to achieve a good crop.

Physical observations :

The detail methods for physical characteristics are described as under:

Plant height :

This parameter was measured by meter scale .

Panicle length :

This parameter was measured by meter scale.

Yield (q/h) :

After harvesting, the produce of each plot was threshed carefully. Grains of each plot were collected and weighed separately. The yield was measured on the basis of q/h.

Yield per plant :

After harvesting of kodo millet, the produce of each plant was collected and threshed carefully. Grains were collected and weighted separately. The yield was measured in gram.

1000-seed weight :

1000 seeds of kodo millet were randomly selected from threshed crop of each plot and their weight was recorded on balance to obtain test weight of seeds.

Colour of seeds :

This parameter was recorded by visuble observation.

Biochemical observation :

Bradford method :

Bradford method is a rapid and accurate method for estimation of protein concentration. The assay reagent was made by dissolving 100mg of Coomassie Blue G250 in 50ml of 95 per cent ethanol. The solution was then mixed with 100ml of 85 per cent phosphoric acid and made upto 1 L with distilled water. Protein standard Bovine globulin at a concentration of 1mg/ml distilled water was used as stock solution. This was stored frozen at -20°C. Since moisture content of solid protein may vary during storage, the precise concentration of protein in the standard solution need to be determined from its absorbance at 595nm.

Crude fibre content :

The content of crude fibre in dried grains of kodo were analyzed by the method as described by Hart and Fisher (1971). 10g oven dried samples were made free from fat by extracting with alcohol (55%) in sox let extraction unit. Two gram fat free sample was transferred into one litre capacity conical flask. 200 ml of 1.25 per cent H_2SO_4 was added to the content of flasks. This was connected with the condensing device and samples were refluxed for half an hour on water bath. The content of flasks were cooled at room temperature and transferred to the Buchner funnel containing muslin cloth as filter. The filtered sample was once washed with hot distilled water followed by several washings with cold distilled water. The residue left on the muslin cloth was transferred to 1.0 litre capacity conical flasks and sample was again digested with 200 ml of 1.25 per cent NaOH in the same fashion as described for digestion with H_2SO_4 solution. After 30 minutes, the content of the flask was cooled and transferred to the same muslin cloth for filter. Then it was washed with hot distilled water followed by several washings with cold distilled water. Finally one washing was done by 95 per cent ethyl alcohol. The residue left on the muslin cloth was transferred to ash less filter paper and dried at 105°C in an oven for 30 minutes. After expiry of the period, the content of ash less filter paper was cooled, in desecrator and calculation was done on per cent basis. Total mineral content was estimated by the method as described by Hart and Fisher (1971). 0.2 g moisture free sample which was dried at 70°C temperature was transferred into ash less filter paper. The ignition of sample was carried out on non-luminous flame in a pre-weighed, teared silica crucible. The crucible was finally placed into muffle furnace which was maintained at 525-550°C (± 2°C) for about 5-6 hours to destroy the organic matter of the sample. After expiry of period, the crucible was transferred into desiccator for cooling to avoid absorption of moisture, by the ash. The cold ash along with silica crucible was weighed and the result was calculated and reported on moisture free basis into per cent.

RESEARCH FINDINGS AND ANALYSIS

There is increasing pressure to grow arable and other crops on land with marginal nutritional or water availability. There is considerable scope for increasing the area under kodo millet taking into a consideration the changing climatic condition and adaptability of this crop, since it is suited for low marginal lands and also harsh weather conditions Plant height was recorded between 50.85 to 70.07cm, similar range was also supported by Joshi (2013). Straw yield was obtained from 1.13 to 2.18 kg and similar range was also reported by Reddy and Reddy (2012). The yield of kodo millet germplasm was found in the range of 12.34 to 15.47 q/ha. Lowest seed yield was obtained in germplasm NDK-10 (12.34 q/ha). Yield /plant was found in the range 1.29 to 3.4 g (Subramanian *et al.*,2010). Other factors such as soil, climate and environment also influenced the test weigh evaluated and kodo millet genotypes on yield contributing characters and found similar range of yield. The various yield factors in kodo millet were also evaluated by Yadav *et al.* (2003) who observed the biological yield per plant and grain yield per plant showed comparatively higher genetic variability and heritability coupled with high to moderate genetic advance as percentage of mean. Hugar and Halikatti (2010) also observed the yield component of minor millet and found higher grain and straw yield in finger millet followed by kodo millet which was significantly superior over other millet crops. The test weight in various germplasm was found in the range of 3.86 to 7.78 g. Highest test weight was recorded in the improved variety NDK-8 (7.78 g) (Table 1). Similar range of test weight in kodo millet germplasm was also reported by Yadav *et al.* (2003) while accessing the yield factor. The variation in the test weight of kodo millet might be due to genetic character as given by Hawladar (1993). The protein content in different genotypes of kodo millet was recorded in the range of the 6.56 to 9.86 per cent (Table 2). Highest protein content was noticed in NDK-8 (9.86 mg/g) and lowest content was recorded in NDK-6 (6.56 %). All the germplasm of kodo millet were found no significant regarding protein content. The highest and lowest protein content in various germplasm might be due to genetic character. The protein content was recorded in the range of 8.05 to 10.46 per cent as given by Jaybhaye *et al.* (2014). The highest and lowest protein content in the germplasm might be due to genetic character of that germplasm. Veena *et al.* (2005) studied the nutritional quality of some kodo millet germplasm and observed similar range of protein. Roopshree *et al.* (2008) studied the seed protein content after harvesting of the crop and found similar range of protein. The protein content of kodo millet was greater than other major cereals as reported by Chandel *et al.* (2014). Bisoi *et al.* (2012) also found protein content 8.7 per cent in kodo millet. The crude fibre content in different genotypes of was recorded in the range of the 5.96 to 6.90 per cent. Highest crude fibre content was noticed in NDK -9 (6.90%) and lowest content was recorded in NDK-10(5.96 %). All the germplasm of kodo millet were found significant regarding crude fibre content. The variation

Table1: Variation of physiological and yield related traits in kodo millet

Sr. No.	Name of germplasm	Place of collection	Plant height (cm)	Panicle length (cm)	Yield (q/h)	Yield/ plant (g)	Straw yield (kg)	1000-seed weight (g)	Colour of seeds
1.	NDK- 1	Lambhua, Sultanpur	55.66	3.72	14.75	3.0	2.04	6.92	Brown
2.	NDK- 2	Dheha,Bahraich	54.66	4.75	13.26	2.0	1.17	4.10	Brown
3.	NDK- 3	Haraiya, Basti	54.95	3.81	15.38	2.10	1.13	3.86	Dark brown
4.	NDK- 4	Baghi, Gonda	53.67	4.29	12.64	1.29	1.49	5.96	Light brown
5.	NDK- 5	Aam Ghat, Deoria	50.85	7.73	14.50	2.60	1.53	4.91	Dark brown
6.	NDK- 6	Basuli, Maharajganj	65.77	5.47	15.47	3.13	1.58	4.81	Dark brown
7.	NDK- 7	Kerakat, Jaunpur	63.48	8.64	13.56	3.40	2.16	4.04	Light brown
8.	NDK- 8	Pithla, Faizabad	59.84	5.54	12.67	1.80	1.18	7.78	Dark brown
9.	NDK- 9	Belipar, Gorakhpur	64.89	4.69	15.33	2.76	2.18	6.03	Light brown
10.	NDK- 10	Badan Gaon Sitapur	70.07	4.00	12.34	1.56	1.75	4.82	Dark brown
	S.E.±		0.04	0.13	0.099	0.05	0.08	0.039	
	C.D. (P=0.05)		0.13	0.38	0.298	0.15	0.24	0.118	

Table 2: Biochemical traits in kodo millet

Sr. No.	Name of germplasms	Place of collection	Protein (mg/100g)	Crude fibre content (%)	Total mineral content (%)
1.	NDK- 1	Lambhua, Sultanpur	6.77	6.76	2.00
2.	NDK- 2	Dheha, Bahraich	7.15	6.81	2.06
3.	NDK- 3	Haraiya, Basti	8.25	6.22	2.01
4.	NDK- 4	Baghi, Gonda	7.68	6.48	1.94
5.	NDK- 5	Aam Ghat, Deoria	8.80	6.74	2.29
6.	NDK- 6	Basuli, Maharajganj	6.56	6.62	2.01
7.	NDK- 7	Kerakat, Jaunpur	9.65	6.80	2.07
8.	NDK- 8	Pithla, Faizabad	9.86	6.46	2.05
9.	NDK- 9	Belipar, Gorakhpur	7.20	6.90	2.08
10.	NDK- 10	Badan Gaon Sitapur	8.26	5.96	2.05
	S.E.±		0.061	0.183	0.059
	C.D. (P=0.05)		0.183	0.554	0.176

in crude fibre content in the germplasm might be due to genetic character of that germplasm (Kulkarni *et al.*, 1992). The total mineral content is different genotypes kodo millet was recorded in the range of the 1.94 to 2.29 per cent. Highest total mineral content was noticed in NDK-5 (2.29%) and lowest content was recorded in NDK-4 (1.94%). All the germplasm of kodo were found significant regarding total mineral content. The variation in total mineral content in the germplasm might be due to genetic character of that germplasm (Veena *et al.*, 2005).

LITERATURE CITED

Ahamed, M. S. and Yadava, H.S. (1996). Assessment of productivity and economics of small millets in Madhya Pradesh. *Crop Res.*, **12** (3):12 – 15.

Bisoi, P.C., Sahoo, G., Mishra, S.K., Das, C. and Das, K.L. (2012).Hypoglycemic effects of insoluble fibre rich fraction of different cereals and millets. *J. Food Process. Technol.,* **3** (7) : 1-11

Chandel, G. Meena, R.K. Dubey, M. and Kumar, M. (2014). Nutritional properties of minor millet. *Curr. Sci.*, **107** (7) : 1109-1111.

Hart, F.L. and Fisher, H.S. (1971). *Modern food analysis.* Springer Verlag, NEWYORK, U.S.A.

Hawladar, M.S.H. (1993). Genetic variability correlation and path analysis in barnyard millet. *Bangladesh J. Scient. & Industrial Res.,* **28** (1):1-6.

Hegde, P.S. and Chandra, T.S. (2005). ESR spectroscopic study reveals higher free radical quenching potential in kodo millet (*Paspalum scrobiculatum* L.*)* compared to other millets. *Food Chem.,* **92** (1):177-182.

Hilu, K.W. (1995). Evolution of finger millets from random amplified polymorphic DNA. *Genome,* **38** : 232-238.

Hugar, A.Y.and Halikatti, S.I. (2010). Studies on the effect of sowing dates and row spacing on the yield components of small millets. *J. Agric. Sci.,* **14**(3):754-757.

Jaybhaye, R.V., Pardeshi, I.L., Vengaiah, P.C. and Srivastava, P.P. (2014). Processing and technology for millet based food product. *J. Ready to Eat Food*, **4**(2): 32-48.

Joshi, V. (2013). Assessment of genetic variability and identification of genotypes for different traits in barnyard millet (*Echinochola* spp.). *Internat. J. Agric.& Food Sci. Technol.,*4 (2):65- 67.

Kulkarni, L.R., Naik, R.K. and Katarki, P.A. (1992). Chemical composition of minor millets. *Karnataka J. Agric. Sci.,* **5** (3) : 255-258.

Reddy, C.V.C.M. and Reddy, P.V.R.M. (2012). Genetic variability for biometrical traits in kodo millet (*Paspalum scrobiculatum* L.). *Br. J. Pharmacol Chemoter*., **2** (12) : 753-755.

Roopshree, Ruiz-Santaella, Bastida, J.P., Franco, F. and De, Prado (2008). Morphological and molecular characterization of different *Echinochloa* spp. and *Oryza sativa* populations. *J. Agric. Food Chem.*, **54**: 1166–1172.

Subramanian, A., Nirmalakumari, A. and Veerabadhiran, P. (2010). Trait based selection of superior kodo millet (*Paspalum scrobiculatum* L.) genotypes. *Electro. J. Plant Breed.,* **1**(4) : 852-855.

The State of Food and Agriculture (2011). *Food and agriculture organization of the united nations,* ROME, ITALY.

Veena, B., Chimmad, B.V. Naik, R.K. and Shantakumar, G. (2005). Physicochemical and nutritional studies in barnyard millet. Karnataka. J. Agric. Sci., **18**(1): 101-105.

Yadav, H.S., Tikle, A.N. and Bhagat, D.V. (2003). Effect of induced mutation through gamma rays on growth and yield parameters of kodo-millet. *J. Soil Crop.* **13**(1): 25-28.

WEBLIOGRAPHY

Heuzé, V., Tran, G. and Giger-Reverdin, S. (2012). Scrobic (*Paspalum scrobiculatum*) forage and grain. Feedipedia.org. (2012). *http://www.feedipedia.org/node/401.*